

**SECTION 735 -- WINGWALLS AND HEADWALLS FOR PRECAST CONCRETE BOX CULVERTS**

**735.01 Description.** This work shall consist of constructing wingwalls and headwalls in accordance with 105.03 and 714. Wingwalls and headwalls may be precast or cast-in-place.

**MATERIALS**

**735.02 Materials.** The materials shall be in accordance with the following:

Flowable Backfill .....	213
Structure Backfill .....	904

Concrete for wingwalls and headwalls shall be Class A and concrete for footings shall be Class B both in accordance with 702 except the coarse aggregate shall be Size No. 91 in accordance with 904.

A water-reducing admixture from the Department's list of approved Water-Reducing Admixtures may be used.

Reinforcing steel in the wingwalls, headwalls, and footings shall be deformed billet steel bars in accordance with 910.01. Reinforcing steel in the headwalls shall be epoxy coated.

Wingwalls shall be connected to the outside box culvert sections. Precast wingwalls shall be connected with bolted steel plates. Steel used in bolted connections of wingwalls to box culvert sections shall be in accordance with ASTM A 709M grade 250 (ASTM A 709 grade 36) and galvanized after fabrication in accordance with ASTM A 153M (ASTM A 153), Class A or B. Bolts shall be in accordance with ASTM A 307 and galvanized in accordance with ASTM A 153M (ASTM A 153).

Weep holes shall be provided in all wingwalls.

**CONSTRUCTION REQUIREMENTS**

**735.03 Shop Drawings.** The Contractor shall submit, for approval, three copies of design computations and five sets of shop drawings with each sheet signed by and bearing the seal of a professional engineer. A longhand example of the design methodology shall be furnished if the design calculations are in a computer printout format. The shop drawings shall include all details, dimensions, and quantities necessary to construct wingwalls and headwalls and shall include, but not be limited to, the following information.

- (a) Footing details showing all concrete dimensions, elevations, and reinforcing steel with bar size, bar bending diagrams, length, and spacing indicated. Footing plan and section views shall be provided. The actual soil bearing pressure shall be noted on the footing detail sheets.
- (b) Wingwall design computations and details showing all concrete dimensions, reinforcing steel, bar bending diagrams, and anchorage details. Wingwall plan, elevation, and section views shall be provided.
- (c) Headwall details, showing all concrete dimensions,

reinforcing steel, bar bending diagrams, and anchorage details. Headwall elevation and section views shall be provided.

(d) Wingwall backfill type and limits.

Wingwall fabrication shall not begin until written approval of the shop drawings and design computations have been received from the Engineer.

**735.04 Design.** The design concrete compressive strength for wingwalls and headwalls shall be 24 MPa (3,500 psi). Wingwalls and headwalls shall be designed based on a minimum equivalent fluid pressure of 6.3 kN/m<sup>3</sup> (40 lb/ft<sup>3</sup>). If flowable backfill is to be used, the Contractor shall consider the effects of hydrostatic pressure on the wingwalls. Horizontal pressures shall be increased for sloping backfill surfaces and live load surcharge. Footings shall be designed for the allowable soil bearing shown on the plans. Wingwalls and wingwall footings shall be designed in accordance with the soil parameters shown on the plans. Wingwall footings and headwall connections shall be checked for sliding and for overturning. Headwalls with bridge rail mounted on top and the anchorage of the headwall to the box culvert section shall be designed for AASHTO traffic railing loadings.

#### **1. Placement of Reinforcement.**

Cover for wingwall and headwall reinforcement shall be a minimum of 50 mm (2 in.). Cover for footing reinforcement shall be 75 mm (3 in.) for the top and sides and 100 mm (4 in.) for the bottom.

**2. Splicing and Spacing of Reinforcing Steel.** Reinforcing steel splicing and spacing requirements shall be in accordance with the AASHTO Standard Specifications for Highway Bridges, except as noted herein. The maximum spacing for wingwall reinforcing steel shall be 450 mm (18 in.) for horizontal bars and 300 mm (12 in.) for vertical bars.

**735.05 Manufacture.** Handling devices or holes will be permitted in each wingwall section. However, not more than four holes shall be cast or drilled in each section. Cast holes shall be tapered.

The wingwalls shall be free of fractures.

Wingwalls shall be given a finish in accordance with 702.21.

**735.06 Marking.** Each wingwall shall be clearly marked with waterproof paint. The following information shall be shown on the inside face of each wingwall.

1. date of manufacture
2. name or trademark of the manufacturer

#### **735.07 Testing.**

**1. Type of Test Specimen** Concrete compressive strength shall be determined from compression tests made on cylinders or cores. For

cylinder testing, a minimum of four cylinders shall be taken during each production run. For core testing, one core shall be cut from each group of four or fewer wingwalls. For each continuous production run, each group of four wingwalls shall be considered separately for the purpose of testing and acceptance. A production run shall be considered continuous if not interrupted for more than three consecutive days.

**2. Compression Testing.** Cylinders shall be made and tested in accordance with ASTM C 39. Cores shall be obtained and tested for compressive strength in accordance with ASTM C 497M (ASTM C 497).

**3. Acceptability of Core Tests.** The compressive strength of the concrete in each group of sections as defined above will be acceptable when the core test strength is equal to or greater than the design concrete strength. The random selection and testing of the cores taken by the manufacturer will be performed by the Department.

If the compressive strength of the core tested is less than the design concrete strength, the wingwall from which that core was taken may be recored. If the compressive strength of the recore is equal to or greater than the design concrete strength, the compressive strength of the concrete in that group of wingwalls will be acceptable.

If the compressive strength of a recore is less than the design concrete strength, the wingwall from which that core was taken will be rejected. Two wingwalls from the remainder of the group shall be selected at random. One core shall be taken from each. If the compressive strength of both cores is equal to or greater than the design concrete strength, the remainder of the wingwalls in that group will be acceptable. If the compressive strength of either of the two cores tested is less than the design concrete strength, the remainder of the wingwalls in the group will be rejected. However, at the option of the manufacturer, each remaining wingwall in the remainder of the group may be cored and accepted individually. The wingwalls which have cores with less than the design concrete strength will be rejected.

**4. Plugging Core Holes.** The core holes shall be plugged and cured by the manufacturer in such a manner that the structure will meet all the test requirements of these specifications. Wingwalls repaired accordingly will be considered satisfactory for use.

**5. Test Equipment.** The manufacturer shall furnish all facilities, equipment, and personnel necessary to conduct the required testing.

**735.08 Rejection.** Wingwalls will also be rejected due to the following conditions.

1. fractures or cracks pass through the wall, except for a single end crack which does not exceed one half the thickness of the wall;
2. defects which indicate proportioning, mixing, or molding which are not in accordance with this specification; or
3. honeycombed or open texture.

**735.09 Repairs.** Wingwalls may be repaired, if necessary, due to imperfections in manufacture, handling damage, or construction. Repairs will be acceptable if it is determined that the repairs are sound, properly finished and cured, and if the repaired wingwall is in accordance with the requirements herein.

**735.10 Compaction.** The soils in the bottom of the excavation shall be compacted to 95% of the maximum dry density. If 95% of the maximum dry density cannot be obtained in the bottom of the excavation or in other areas, the Materials and Tests Division's Geotechnical Section shall be contacted for additional recommendations. If during construction, soft soils are encountered at depths that make removal impractical, the Materials and Tests Division's Geotechnical Section shall be contacted for additional recommendations.

**735.11 Footings.** Footings may be cast-in-place or precast. When a precast footing is utilized, a 100 mm (4 in.) layer of coarse aggregate No. 53 in accordance with 301 shall be placed under the full width of the footing. All footings shall be given a smooth float finish. The footing concrete shall reach a compressive strength of 13 800 kPa (2,000 psi) before placement of the wingwalls. The surface shall not vary more than 6 mm in 3 m (1/4 in. in 10 ft) when tested with 3 m (10 ft) straightedge.

**735.12 Placement of Wingwalls.** The wingwalls shall be set on masonite or steel shims. A minimum gap of 13 mm (0.5 in.) shall be provided between the footing and the bottom of each wingwall. The gap shall be filled with a mortar in accordance with 707.09.

**735.13 Backfilling.** Tapered or drilled holes for handling shall be filled in accordance with 907.05. Prior to backfilling the wingwall, all holes shall be covered with joint wrap material with a minimum width of 225 mm (9 in.).

Structure backfill shall be placed and compacted in accordance with 211.

**735.14 Method of Measurement.** Wingwalls will not be measured for payment. The accepted quantities for payment will be the quantities shown in the Schedule of Pay Items.

Structure backfill will be measured in accordance with 211.09. Flowable backfill will be measured in accordance with 213.06.

**735.15 Basis of Payment.** The accepted quantities of wingwalls will be paid for at the contract unit price per square meter (square foot) for wingwalls. Structure backfill will be paid for in accordance with 211.10. Flowable backfill will be paid for in accordance with 213.07.

Payment will be made under:

<b>Metric Pay Item .....</b>	<b>Metric Pay Unit Symbol</b>
<b>(English Pay Item .....</b>	<b>English Pay Unit Symbol)</b>

Wingwall .....	m2 (SYS)
----------------	----------

The cost of designing, coring, testing, reinforcing steel, excavation, repairs, plugging core and handling holes, mortar, and

necessary incidentals shall be included in the costs of the wingwall.

The cost of the footings for wingwalls and the aggregate base under the wingwall footings shall be included in the cost of the wingwall. The cost of the headwalls shall be included in the cost of the box culvert.

---